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Abstract

This study analyses all suicides and related prior attempts occurring in Northern Ireland over two years, focussing on number and timing of attempts, method, and mental health diagnoses. Cases were derived from Coroner's records, with 90% subsequently linked to associated General Practice records. Of those included 45% recorded at least one prior attempt (with 59% switching from less- to more-lethal methods between attempt and suicide). Compared with those recording one attempt those with 2+ were more likely to have used less-lethal methods at the suicide (OR=2.77: 95%CI=1.06, 7.23); and those using less-lethal methods at the attempt were more likely to persist with these into the suicide (OR=3.21: 0.79, 13.07). Finally, those with pre-existing mental problems were more likely to use less-lethal methods in the suicide: severe mental illness (OR=7.88: 1.58, 39.43); common mental problems (OR=3.68: 0.83, 16.30); and alcohol/drugs related (OR=2.02: 0.41, 9.95). This analysis uses readily available data to highlight the persisting use of less-lethal methods by visible and vulnerable attempters who eventually complete their suicide. Further analysis of such conditions could allow more effective prevention strategies to be developed.

Introduction

Reducing suicide is a significant public health challenge. Known risk factors have long included socio-economic deprivation and worklessness (Moser *et al*, 1984; Lewis *et al*, 1998; O'Reilly *et al*, 2008), male gender (Shiner *et al*, 2009; Canetto *et al*, 2012), age (Mok *et al*, 2012) and psychiatric illness (Carlsten *et al*, 2001; Oquendo *et al*, 2003). Genetic markers have also been associated with suicide ideation (Laje *et al*, 2007) and latterly it has been suggested that epigenetic mechanisms may play a role in attempted suicide (Murphy *et al*, 2013). Importantly,

suicide is considered by some as preventable (Wheller *et al*, 2007). However, while many of its indicators are pervasive, suicide remains relatively rare, and it has been suggested that such risk factors have only limited predictability when applied to individual cases (Beautrais, 2007; Caine, 2010). For example, for every suicide death there are twenty-five non-fatal attempts (Maris, 2000). Therefore while prior attempts can predict eventual suicide, increasing risk by 10-15% (Cullberg *et al*, 1988; Maris, 1992; Cederecke *et al*, 2005), reliance on it as a predictor is not realistic (Owens *et al*, 2002). Nevertheless, readily available information relating to prior suicide behaviour may be useful in developing prevention strategies sufficiently targeted to both predict and respond to those likely to be at greatest risk.

Consequently, focus has shifted to identifying characteristics which might distinguish people at particularly high risk following attempted suicide. Studies have examined the length of time an individual remains at risk after an attempt: one Finnish study found that 44% of suicides had recorded prior attempts - 19% in the twelve months prior to death (Isometsa *et al*, 1998). Research has also examined the characteristics of the suicide method, with elevated risk of eventually completing suicide indicated through use of more lethal methods (Isometsa *et al*, 1998) and increasing severity of poisoning (Runeson *et al*, 2010). Such information may help develop better-targeted prevention efforts: for example, in monitoring sequential admission patterns for self-poisoning (Runeson *et al*, 2010) or intensified aftercare (Isometsa *et al*, 1998). There is little research on the patterning of methods used in suicide attempts and the temporal relation of these attempts to eventual suicide. This paper explores both this temporal patterning of prior attempts, including their number and timing, methods used and the persistence of less lethal methods across multiple attempts.

Method

This is a retrospective study of all deaths in Northern Ireland (NI) determined to be suicide by the NI Coroner Service (NICS) between 1st March 2007 and 28th February 2009. Data were extracted and collated between January and November 2011 from two sources: Coroner records and associated General Practitioner (GP) medical records. Permission to access the data was granted using the 'research exemption' Section 33, of the Data Protection Act. Ethical approval was obtained from the NI branch of the UK Office for Research Ethics Committee (ORECNI).

Data relating to suicide attempts were extracted from the GP record: it was possible to report only on acts of self-injury resulting in either attendance with medical practitioners or at hospital Emergency Departments.

Distinguishing between a failed attempt and a suicide gesture is difficult (Williams, 1997) - the definition used here is "an act with non-fatal outcome, in which an individual deliberately initiates a non-habitual behaviour that,

without intervention from others, will cause self-harm, or deliberately ingests a substance in excess of the prescribed or generally recognised therapeutic dosage and which is aimed at realising changes which the subject desired via the actual or expected physical consequences” (Kerkhoff *et al*, 1994).

The data were collected by two researchers. To ensure inter-rater reliability a cross sample of ten cases was compared. While data relating to suicide attempts were largely extracted from information sent to GPs by doctors working in Emergency departments, some were obtained from related psychiatric reports. These detailed both presentation at hospital following an instance of deliberate self-harm and any related assessments made or treatments given. The summary methods used for the analysis included re-classification into lethal or less-lethal types, and draws on both the Runeson study (Runeson *et al*, 2010) and the Harvard assessment of lethality (Harvard School of Public Health. Lethality of Suicide Method, 2013). To derive these we have taken a pragmatic view and in aggregating the specific methods used included wider elements of intent, lethality and prospective finality or fatality in the classification: lethal methods include hanging, gun-shot and jumping; less-lethal methods include drugs overdose, poisoning, drowning, cutting and asphyxiation by gassing.

Other indicators related to the attempt include: time from last prior attempt to the completed suicide – dichotomised into less than a year, and one or more years; number of prior attempts – again dichotomised, as either one attempt, or two or more; and level of lethality of method. Finally, already diagnosed pre-existing mental health problems were included for analysis, summarised into three groups: (i) *common mental health problems* included depression, anxiety, phobias, stress, psychological disorders and PTSD; (ii) *severe mental illness* comprised schizophrenia, psychosis, bipolar disorder and personality disorders; and (iii) *alcohol/drugs problems* included those with alcohol and/or drug dependency problems. However, some misclassification is possible, since real mental disorders could have remained undiagnosed.

Results

Over the study period 403 suicides were recorded by the NICS (325 males and 78 females). Of these 42 sets of GP records were missing (34 males and 8 females): 14 were not registered with a GP and 28 sets of medical records were unavailable. These were excluded from analysis. The study population comprised 291 male and 70 female suicides – their ages ranged from 11 to 83 (mean 39.6 and SD=16.189). There was no significant age difference between males and females.

Table 1 shows that of those with a medical record 44.0% (159/361) were treated by a medical practitioner at some point in relation to a suicide attempt – 56.0% (202/361) therefore died at their first attempt: with males recording 86.1% (174/202) of deaths ($\chi^2=8.970$ $p=0.003$). However, while males comprised 74% (117/159) of suicides

following a prior attempt, among females 60% (42/70) of completed suicides were preceded by an attempt, compared to 40% (117/291) for males.

Table 1 also outlines the number of attempts by age group. Among males, a single attempt was recorded for 53% (62/117) and 47% (55/117) two or more attempts. Older males (>35years) were more likely to have recorded a single attempt, and younger males (< 35) more likely to record two or more. Multiple attempts were recorded for 63% (12/19) of males aged less than twenty-five. A preferential accumulation of prior attempts by females shows in the age distribution. Among females aged 35-64, more than 70% within each age group recorded a history of attempts. For males 25-64 the comparable proportions were less than 50%. Generally, the youngest and oldest age-groups were less *visible* in this respect, with both less likely to have recorded a previous attempt.

While for 55.4% (88/159) of cases the final attempt occurred more than a year before the completed suicide, for 10.7% (17/159) the attempt occurred in the thirty days before (Table 1), with males comprising 88.2% (15/17) of this group. However, while with males the proportions increased in those aged 25-64 (rising from 6% to 20%) for the youngest age group 68.3% (13/22) made the attempt within a year. While numbers recorded for the shortest time period are low, they at least give an idea of the timing. Other more narrowly defined time periods tested did not warrant specific inclusion - for example 0.4% (7/159) and 0.6% (10/159) persons made their final attempt <7 and <14 days respectively before the completed suicide.

Table 2 shows the relationship between the methods used (dichotomised as lethal and less-lethal) in the completed suicide and its immediately prior attempt. Columns 2 and 3 record both the proportions of attempts and completed suicides classed as lethal: for males 20.5% and 82.1% respectively were classed as lethal; while for females the comparable figures are 17.1% and 66.7%. The final column shows the net shift from less- to more- lethal methods between the immediately prior attempt and the completed suicide: 61.55% of males and 50.0% of females changed to more lethal methods to complete the suicide, suggesting an enhanced intensity of intent. Table 3 examines the accumulation of more- or less- lethal methods over each of the attempts (to a maximum of five): overall 70% (249/352) of all attempts were classed as less lethal – ranging from 58%-76% across the groupings. While males were more likely to record a lethal attempt than females, in all groups less lethal methods comprised at least 50%. This contrasts with those who died without recording a prior attempt - 87% (209/239) used a method classed as lethal: with 88% (180/204) and 81% (29/36) associated with males and females respectively; of these 79% and 75% were by hanging. The other major suicide method considered specifically is drugs overdose: while this was the prevalent method associated with attempts, it was used in less than 1% of male and 11% of female suicides. Of twenty-six persons recording at least five attempts, fifteen (58%)

recorded overdoses in at least four of their five attempts. In these cases the switch was mainly from (attempts using) drugs overdose to completed suicide, with hanging the preferred method.

Both the known finality of lethal methods, and the definitive switch in method between the final prior attempt and the completed suicide signal an apparent concentration of intent. However, this allows interest to focus on those who persist in using less lethal methods into the completed suicide – and specifically on the risks associated with those indicators marking the prior history of the deceased as they continue from attempt to completion. Table 4 records the Odds Ratios (ORs) associated with the use of less lethal methods in the suicide: in all models the dependent variable is more-lethal (0) V less-lethal (1). Indicators included in the models were selected because they both represent known risk factors (age, gender, employment status, living alone) and, in the final model (M4), includes the indicators associated with prior suicide attempts. This shows that female suicides, older people and those not living alone were more likely to use less lethal methods than their associated reference groups (M1-M4). When compared with those who had no pre-existing diagnosis, persons with an assigned mental health diagnosis were also more likely to use less lethal methods in their suicide (M3) – here the ORs associated with the summary diagnostic groups are 1.93, 4.98 and 1.38 for *common mental health problems*, *severe mental health disorders* and *alcohol/drugs problems* respectively (M3). However, when the analysis is restricted to those with a history of prior attempts the comparable ORs almost double (M4). This final model (M4) also includes indicators associated with the final attempt prior to the suicide – here those who used a less lethal method in this attempt were more likely to persist with less lethal methods at the suicide (OR=3.21: 95%CI=0.79, 13.07). Finally, those who had recorded two or more previous attempts were also more likely to have used less lethal methods in the suicide (OR=2.77: 95%CI=1.06, 7.23).

Discussion

Suicide rates in Northern Ireland nearly doubled between 1995 and 2011, increasing from 8 to 15 per 100,000 of the population (NISRA. Suicide death rates by sex, 1997-2012). This analysis explores attempted suicide associated with all completed suicides identified through Coroner's records occurring over a two year period. Associated GP records allowed a comprehensive examination of three aspects of suicide attempts: their number, timing of the final attempt and suicide; and changing method between attempts.

The analysis explores suicide behaviour over a reasonably long time frame - while all suicides occur in the two year window, no back limit was placed on accumulation of relevant information, especially the history of prior attempts. Our findings (consistent with the literature) suggest that men are more likely than women to use lethal methods on initial attempts or switch to them at an

earlier stage – maybe implying sustained intent on their part. This tendency limits opportunities to intervene with males. For females, in this analysis the patterns associated with their suicide behaviour (and continued higher levels of use of less-lethal methods) points to a lesser intensity, and allows for more optimism in relation to the potential for intervention. This and other research shows that these particularly vulnerable groups may be more easily identified as at continued higher risk of completing suicide (Runeson, 2002). While for males the sustained lethality of the methods used is a formidable barrier to intervention, the circumstances surrounding attempts and the presentation of these men at emergency services shortly before death, suggests there may be both some unexploited opportunities for intervention and a need for sustained short-term support and outreach. This patterning of repeated ‘less-lethality’ between attempts and subsequent suicide, especially for those with pre-existing diagnoses of mental health problems, may help in pin-pointing the signals necessary for successful intervention (Rudd *et al*, 2006).

Despite the difficulties inherent in predicting repeated attempts, the important role of hospital Emergency Departments is recognised in the second generation of UK national programmes targeting suicide prevention. Two National Institute of Health and Clinical Excellence (NICE) Reports are aimed at both the short and longer-term management and prevention of self-harm in primary and secondary care (NCG16 Self-harm Clinical Guidelines, 2004; NCG133 Self-harm, 2011). There has been increased emphasis on practical prevention measures and the lack of follow-up for those presenting with self-harm at Emergency Departments has been highlighted as a particular problem (Mehlum, 2004; McMillen *et al*, 2009; DoH, 2012).

Surviving an attempt is not necessarily to be represented as an indication that an individual is on a pathway to a subsequent completed suicide. However, it is difficult with this dataset to directly address issues of prevention, given that it comprises individuals all of whom eventually died by suicide. The death of the individuals reported on here suggest that such presentations at Emergency Departments are no easy route to long-term safety. For a majority of cases in this dataset survival from a prior attempt merely meant that more lethal methods were used subsequently. Nevertheless, presentation to a health professional following a suicide attempt is potentially an important step on a help-seeking pathway. Detailed accounts of life-time patterning of help-seeking in relation to suicide attempts are poorly reported in the literature and we thus have limited understanding of both how health and social care systems manage potential suicide cases *and* how this might influence subsequent engagement with health care services. Further research is needed on how people who attempt suicide are assessed and responded to in hospital emergency settings and the factors that influence subsequent help-seeking.

Limitations

There are some limitations to the data. While medical records were not available for 10% of the cohort, a sensitivity analysis showed no bias in terms of age or gender. Neither of these data sources were originally

designed to study attempted suicide and completeness of the record is reliant on (a) the person making the attempt seeking medical attention, and (b) effective communication between Emergency Departments and General Practitioners. It is therefore possible that recorded attempts can underestimate the true burden of attempted suicide. However, there are strengths to this approach – the records capture only those events serious enough to warrant presentation to a medical practitioner, and these provide opportunities for intervention.

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	<25	25-34	35-44	45-54	55-64	65+	total
males							
prior attempts=no	66.1 (37)	52.9 (37)	56.4 (31)	63.2 (36)	51.6 (16)	77.3 (17)	59.8 (174)
prior attempts=yes	33.9 (19)	47.1 (33)	43.6 (24)	36.8 (21)	48.4 (15)	22.7 (5)	40.2 (117)
prior attempts							
1 recorded	36.8 (7)	48.4 (16)	50.0 (12)	57.1 (12)	66.7 (10)	100.0 (5)	53.0 (62)
2 or more	63.1 (12)	51.5 (17)	50.0 (12)	42.9 (9)	33.3 (5)	0.0 (0)	47.1 (55)
final attempt							
<30 days before	15.8 (3)	6.1 (2)	12.5 (3)	19.1 (4)	20.0 (3)	0.0 (0)	12.8 (15)
less than 1 year	68.3 (13)	45.4 (15)	45.8 (11)	38.1 (8)	40.0 (6)	20.0 (1)	46.2 (54)
1+ years	31.6 (6)	54.6(18)	54.2 (13)	61.9 (13)	60.0 (9)	80.0 (4)	53.9 (63)
females							
prior attempts=no	73.3 (11)	44.4 (4)	28.6 (6)	21.4 (3)	25.0 (1)	42.9 (3)	40.0 (28)
prior attempts=yes	26.7 (4)	55.6 (5)	71.4 (15)	78.6 (11)	75.0 (3)	57.1 (4)	60.0 (42)
prior attempts							
1 recorded	50.0 (2)	40.0 (2)	26.7 (4)	27.3 (3)	100.0 (3)	50.0 (2)	38.1 (16)
2 or more	50.0 (2)	60.0 (3)	73.3 (11)	72.7 (8)	0.0 (0)	50.0 (2)	61.9 (26)
final attempt							
<30 days before	0.0 (0)	20.0 (1)	6.7 (1)	0.0 (0)	0.0 (0)	0.0 (0)	4.8 (2)
less than 1 year	25.0 (1)	40.0 (2)	46.7 (7)	18.2 (2)	100.0 (3)	50.0 (2)	40.5 (17)
1+ years	75.0 (3)	60.0 (3)	53.3 (8)	81.8 (9)	0.0 (0)	50.0 (2)	59.5 (25)
persons							
prior attempts=no	67.6 (48)	51.9 (41)	48.7 (37)	55.9 (39)	48.6 (17)	69.0 (20)	56.0 (202)
prior attempts=yes	32.4 (23)	48.1 (38)	51.3 (39)	44.1 (32)	51.4 (18)	31.0 (9)	44.0 (159))
prior attempts							
1 recorded	39.1 (9)	47.4 (18)	41.0 (16)	46.9 (15)	72.2 (13)	77.8 (7)	49.1 (78)
2 or more	60.8 (14)	53.3 (20)	59.0 (23)	43.2 (17)	27.8 (5)	22.2 (2)	51.0 (81)
final attempt							
<30 days before	13.0 (3)	7.9 (3)	10.3 (4)	12.5 (4)	16.7 (3)	0.0 (0)	10.7 (17)
less than 1 year	60.9 (14)	44.7 (17)	46.2 (18)	31.3 (10)	50.0 (9)	33.3 (3)	44.6 (71)
1+years	39.1 (9)	55.3 (21)	53.9(21)	68.8 (22)	50.0 (9)	66.7 (6)	55.4 (88)

Table 2: completed suicides in Northern Ireland (April 2007 - March 2009). Characteristics of the type of method used (more-lethal v less-lethal), in both the completed suicide and its immediately prior attempt

	last prior attempt (n)	last prior attempt classed as lethal % (n)	suicide classed as less-lethal %(n)	change in method: less-lethal to lethal %(n)
males	117	20.5 (24/117)	82.1 (96/117)	61.5 (72/117)
females	42	17.1 (7/42)	66.7 (28/42)	50.0(21/42)
persons	159	19.5 (31/159)	80.0 (124/159)	58.5 (93/159)

Table 3: completed suicides in Northern Ireland (April 2007 - March 2009), and associated counts of prior attempts. Characteristics of the type of method used, in both (a) the completed suicide and (b) its associated prior attempts (maximum=5)						
		number of recorded prior attempts (para-suicides) occurring before the completed suicide				
	no prior attempts recorded: suicide only	one prior attempt recorded	two attempts recorded	three attempts	four attempts	five
Persons completed suicides	238	77	30	16	9	26
number of attempts recorded	na	77	60	48	36	130
method: classed as lethal	209	23	18	15	15	31
method: classed as less-lethal	29	54	42	33	21	99
proportion: less-lethal	12.2%	70.1%	70.0%	68.8%	58.3%	76.2%
males completed suicides	202	62	21	12	6	16
method: classed as less-lethal	22	43	29	20	12	57
proportion: less-lethal	10.9%	69.4%	69.0%	58.8%	50.0%	72.2%
attempts: % hanging	79.4%	8.1%	19.0%	20.5%	21.8%	5.3%
attempts: % drugs overdose	0.9% (2)	69.4%	69.0%	59.0%	45.8%	72.0%
females completed suicides	36	15	9	4	3	10
method: classed as less-lethal	7	11	13	13	9	40
proportion: less-lethal	19.4%	73.3%	72.2%	91.6%	75.0%	80.0%
attempts: % hanging	75.0%	-	11.1%	-	5.6%	2.0%
attempts: % drugs overdose	11.1% (4)	62.5%	72.2%	91.7%	50.0%	80.0%

Table4. Completed suicides in NI (March 2007 – February 2009): the persistence of use of less-lethal methods for suicide attempts, when compared against those who use more-lethal methods, by selected known risk factors and indicators of prior suicide behaviour. Data represents Odds Ratios (and 95% confidence intervals) from logistic regression analysis quantifying the ORs associated with the use of less lethal methods in the completed suicide.				
M1	M2	M3	M4	

	gender & age, over the whole cohort	M1 + socio- demographic characteristics	M2+ diagnosis	M3 + characteristics of final prior attempt (over 159 subjects recording a prior attempt)
Gender: male female	1.00 2.19 (1.16, 4.14)*	1.00 2.36(1.17, 4.77)*	1.00 2.15(1.03, 4.48)*	1.00 1.71 (0.62, 4.71)
Age group: <35 35-54 55+	1.00 2.56(1.27, 5.16)** 3.82(1.72, 8.52)**	1.00 2.28(1.11, 4.69)* 3.28(1.44, 7.47)**	1.00 2.10 (0.99, 4.47) 2.95 (1.25, 6.97)*	1.00 3.23 (1.07, 9.73)* 3.75 (1.19, 19.05)*
Living alone: yes no		1.00 2.76(1.52, 5.02)**	1.00 2.47(1.34, 4.59)**	1.00 3.02 (1.20, 7.60)*
In paid employment: yes no		1.00 1.20(0.64, 2.23)	1.00 0.94 (0.48, 1.81)	1.00 0.82 (0.33, 2.04)
Mental health problem diagnosed: type no common MH problems severe mental illness alcohol/drugs			1.00 1.92(0.86, 4.25) 4.98(1.98,12.49)** 1.38(0.49, 3.86)	1.00 3.68 (0.83, 16.30) 7.88 (1.58, 39.43)* 2.02 (0.41, 9.95)
Final prior attempt: lethal method used: Yes No				1.00 3.21 (0.79, 13.07)
Final prior attempt : Less than 1 year before One or more years before				1.00 1.08 (0.44, 2.66)
Number of prior attempts One only Two or more				1.00 2.77 (1.06, 7.23)*